# Serious Hand Sepsis and Diabetes Mellitus: Specific Tropical Syndrome with Western Counterparts

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**Infection in the extremities of diabetic patients most commonly involves the feet and, at least in western societies, is often associated with chronic complications of diabetes. Severe hand infection, often culminating in amputation and even death, is, however, well-described in tropical countries, where it may not be associated with any evidence of neuropathy or arterial insufficiency. Similar cases are described in the western literature but are more often associated with more severe antecedent trauma. The literature describing hand sepsis in diabetic patients both in tropical and in western practice is reviewed and we draw some conclusions about pathogenesis and treatment from the literature and from original data documenting the varying experience of hand sepsis in diabetic practice throughout Africa. © 1998 John Wiley & Sons, Ltd.**

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## Introduction

It is generally accepted that infections in diabetic subjects are more common than in non-diabetic counterparts; and that when infections occur they may be more advanced and serious.[1] This concept may be an over-simplification however; not all infections may be more common, and increased risk of infection may apply only or mainly to those with poor glycaemic control.[2,3] There is however no question that foot sepsis, usually occurring as a result of neuropathic or ischaemic ulceration, is common in diabetic subjects and it may have serious consequences including amputation and even death.[4,5] Infections of the hand however are relatively uncommon and not in general recognized as a specific diabetic problem, at least in western countries. In the tropics, however, and in Africa in particular, severe hand sepsis in diabetic patients is a well-recognized though still relatively uncommon complication.[6] The syndrome was first reported in detail by Akintewe and colleagues in 1984,[7] though it was certainly recognized by clinicians in the continent well before then. It has been termed the 'Diabetic Hand'[8] or 'Tropical Diabetic Hand (TDH) syndrome'.[6] In this article we wish to draw attention to this unusual and severe diabetic complication and to review the available literature as well as the experiences of ourselves and others.

## Clinical Features of Diabetic Hand Sepsis in the Tropics

The often dramatic and severe nature of hand infection amongst African diabetic patients is demonstrated by Figures 1 and 2. Their clinical details are appended. Diabetes (usually Type 2) is often poorly controlled and the patients may have lapsed from treatment. There may be antecedent trauma (though usually not severe) and hospital admission is sometimes delayed by traditional remedies. Neuropathy is a variable finding. Severe necrotizing infection often spreads and may require radical surgery including amputation.

In the original description by Akintewe *et al.*,[7] 6 Nigerian cases were described from a clinic population of 160 (4 %). The patients were of mean age 43 (range 26–58) years and 3 were on insulin treatment. In all there was a history of mild preceding trauma but no patients had clinical evidence of neuropathy or peripheral vascular disease. *Staphylococcus* was the most common pathogen isolated. The authors compared these patients with those having foot ulcers and found that the hand ulcer patients were younger (mean 43 vs 56 years) and

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Figure 1. Example of the Tropical Diabetic Hand syndrome. The patient is a 40-year-old Gambian man with poorly controlled Type 2 diabetes. Trivial palm trauma 3 weeks previously was ignored, and he presented with serious deep palmer sepsis tracking and pointing up the thumb. Despite vigorous drainage and antibiotic treatment, amputation of the thumb was later necessary

Figure 2. This 35-year-old Gambian lady presented ill and toxic with deep palmer sepsis. There was no history of trauma, but she had had Type 2 diabetes for several years with no recent follow-up. Presentation was delayed by witch-doctor treatment. Infection tracked up the arm with severe necrosis and tissue loss. She escaped amputation, but was left with reduced forearm flexion and function

that neuropathy or vascular disease were common in foot ulcer patients.

In a more detailed clinical description of 5 of these cases,[8] the authors emphasized the constant features of preceding trauma, poor glycaemic control, and delayed presentation. The type of trauma included mild abrasions and lacerations, and insect bites.

Subsequent reports of hand ulceration and sepsis in African diabetic patients are scant. In a report from Nairobi, Kenya, McLigeyo and Otieno[9] studied 100 consecutive diabetic patients presenting with ulcers at any site. Fifteen (15 %) involved the hand, the rest occurring on the leg or foot. Unlike the original series of Akintewe *et al.*,[7,8] 9 of these 15 patients were described as having ulcers which were 'neuropathic', though the criteria on which this diagnosis was based were not given.

A report on major limb amputations from Zaria, Nigeria included 115 upper limb amputations presenting between 1980 and 1989.[10] Of these, 2 (1.7 %) were described as being due to 'diabetic gangrene', though other details were not given. The same problem accounted for 6.8 % of lower limb amputations.

Reports from The Gambia[11,12] in West Africa have also highlighted severe hand sepsis as a significant problem, though again less common than foot ulceration and infection. Detailed figures were not provided, but it was mentioned that both foot and hand sepsis were more common in women. The female excess was thought to be possibly due to cultural practices, leading women to attend hospitals less frequently than men, and generally to present later. Morbidity (including amputations) also appeared excessive.

A study from Libya in North Africa investigated the occurrence of foot and hand sepsis in a large diabetic population in Tripoli.[13] Of 815 patients, 60 (7.4 %) had suffered 90 episodes of foot or hand infection. The hand was involved in 31 (34 %) cases. Compared with foot sepsis patients, those with hand infection were characterized by significant female preponderance (74 % hand vs 37 % foot, $p < 0.02$) and younger age (51 years vs 58 years, $p < 0.02$). Trauma initiated hand infection in 26 % of cases and in 19 % the episode of infection was the presenting feature of diabetes. Neuropathy occurred in 25 % but none had peripheral vascular disease. Prolonged hospitalization with surgical intervention was often needed: 11 % eventually required some form of amputation.

Finally, a recent Tanzanian report records 4 diabetic patients (1 male, 3 females; ages 41–72 years) with severe hand sepsis.[14] Despite intravenous antibiotics and surgical debridement, all the patients died. None had a clear history of initiating trauma. The authors felt that early aggressive surgery should be considered in such cases.

## Diabetic Hand Sepsis in Western Countries

The American literature contains some studies of hand sepsis in diabetic patients. McConnell and Neale[15] reported 204 cases in Ohio between 1975 and 1977, of whom 15 (7 %) were diabetic. Stern and colleagues[16] investigated optimal antibiotic treatment in 200 cases reported to a Hand Surgery Service. Ten (5 %) of their series had diabetes. Of 138 patients reported from Texas[17] between 1970 and 1980, 10 (7 %) were diabetic. The authors of this study considered that the diabetic patients healed more slowly on antibiotic treatment and were more likely to need surgery. Mandel[18] investigated 12 consecutive hand sepsis patients for diabetes, and found 3 to have 'overt' and 4 'latent diabetes'. It is



 

difficult to comment on this study as the diagnostic criteria for diabetes used are now regarded as outmoded and the single case recorded in any detail does not contain enough information to support a diabetes diagnosis.

A report in 1977 from Florida[19] described 20 episodes of severe hand infection among diabetic patients, between 1969 and 1975. Initial trauma occurred in 14 (70 %) patients who ranged from 33 to 65 y and most (15 or 75 %) were on diet with or without oral hypoglycaemic agents. Sepsis was severe in all cases; indeed this was a selected study of hospitalized patients only. Seven required amputations and this paper has striking illustrations very similar to contemporary experience of the diabetic hand sepsis syndrome in Africa. Indeed, the two illustrative case histories mentioned were both of ethnic minority patients, and in one hospitalization was delayed due to home treatment with 'roots'. The authors noted an average lapse of 10 days in the group between onset of infection and seeking medical attention, which they suggested might have been due to neuropathy masking pain. Clinical evidence of neuropathy was not however recorded although nerve conduction studies were done in 'a few patients' and showed 'delayed conduction'. Overall glycaemic control in these patients was not recorded or commented upon. The study pre-dated $HbA_{1C}$ assays and generalized attempts at optimal glycaemic control in diabetic patients. It seems likely that the patients recorded were poorly controlled and, as mentioned above, this study is very reminiscent of the current Third World situation with diabetic hand sepsis.

Finally, Francel and colleagues[20] reported 41 patients who presented with severe hand infections between 1978 and 1988. Ten of the patients had chronic renal failure and in most of these the hand infections were related to infection and/or embolism from proximal forearm arteriovenous fistulae for dialysis. Some were on immunosuppressive treatment. Of the others, many had preceding trauma which in a number of cases was severe (e.g. serious crush injury). The overall amputation rate was 63 %.

## Aetiology and Risk Factors

### *Evidence from the Literature*

The literature discussed above may provide clues as to causative factors in Tropical Diabetic Hand (TDH) syndrome. The most useful African studies available are those from Nigeria[8] and Libya.[13] The frequency of hand sepsis was remarkably similar in the two – 5/158 patients (3.2 %) in Nigeria and 25/814 in Libya (3.1 %), as was the female excess (80 % in Nigeria and 74 % in Libya). Mean ages were 41 years and 51 years, respectively. Most patients, as expected, had Type 2 diabetes. Trauma was a frequent precursor, though it was often trivial. The Nigerian report in particular noted delay in hospital presentation. Neither study considered neuropathy or peripheral vascular disease of importance.

In the western literature, the US study of Mann and Peacock[19] is the most detailed. Mean age, 55 years, was similar to the African studies cited above, and 75 % had Type 2 diabetes. Sex ratio was not recorded. There was evidence of late presentation, and probably poor glycaemic control and low socio-economic status.

### *African Experience*

It has been our impression that the TDH syndrome varies in prevalence quite markedly around the African continent. We contacted by letter physicians running diabetic clinics in 12 different parts of Africa. A colour photograph of a typically infected diabetic hand was sent, and we asked whether in their own experience the syndrome was (a) rare (less than 1 case/year), (b) uncommon (1–2 cases/year), or (c) relatively common (more than 2 cases per year). We received 12 (75 % response rate) replies, and the results are shown in Table 1. Obviously, it is difficult to draw conclusions from such data, but there appears to be a tendency for the condition to be seen more frequently in coastal rather than interior areas. In Zambia, for example, our correspondents had never seen a case (in 5 years of extensive diabetic practice), whereas in coastal West Africa, diabetic hand sepsis was relatively common. It may be that humidity is a risk factor and some believe that sepsis tends to increase generally in humid seasons. However, there has not been a reported increase in appearance of diabetic hand sepsis in the humid season. Many of our contacts mentioned that poor diabetic control and compliance were common factors, as well as poor socio-economic status and labouring jobs. The use of herbal preparations was also reported, but this may not necessarily be a direct toxic effect of the herbs, but rather could operate through the associated delay in presentation to hospital. Finally, lack of skilled surgical treatment and antibiotics may also be relevant. Thus in western countries, minor hand sepsis in diabetic patients is likely to be vigorously treated by specialists with hand surgery expertise and with potent antibiotics. In most parts of Africa, such

Table 1. Occurrence of Tropical Diabetic Hand syndrome in different parts of Africa

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| 1. | *Relatively common* (>2 cases/year) | Ethiopia<br>Gambia<br>Libya<br>Nigeria (south)<br>South Africa (Natal)<br>Tanzania |
| 2. | *Uncommon* (1–2 cases/year) | Nigeria (north)<br>South Africa (Transvaal) |
| 3. | *Rare* (<1 case/year) | Botswana<br>Malawi<br>Zambia<br>Zimbabwe |

facilities are rarely available. In Table 2 we summarize what appear to be important risk factors for TDH syndrome from the current literature, our own experiences and those of our contacts.

## Bacteriology

The literature on the microbiology of hand infections suggests that the majority are caused by Gram-positive organisms, predominantly *Staphylococcus aureus* followed by *Streptococcus* spp.[15,16,20,21–24] Gram-negative organisms have also been demonstrated.[19] Several of the reports also demonstrated mixed bacterial growth, containing both aerobic and anaerobic organisms. Among Gram-negative organisms, *Klebsiella* spp., *Enterobacter* spp., *Proteus* spp., and *E. coli* were commonly isolated from patients.[8,19]

Dellinger and colleagues[21] studied a series of 193 patients and showed that the presence of mixed growth with a large number of organisms, or of anaerobes, was associated with an unsatisfactory response to antimicrobial therapy; the presence of *S.aureus* and/or β-haemolytic *Streptococcus* spp. was associated with favourable outcome. They speculated that these two organisms were able to invade without prior extensive tissue damage or deep tissue inoculation. They also found that no single organism was associated with serious complications and that the incidence of treatment failure or unsuccessful outcome did not relate to antimicrobial resistance for each group of organisms isolated.

Hand infection caused by certain organisms may result in recognized clinical syndromes.[25] For example, the unique symbiotic relationship between *S.aureus* and anaerobic *Streptococcus* spp. results in a progressive synergistic gangrene (Meleney's gangrene) confined to the superficial fascia. The most common cause of polymicrobial synergistic gangrene is a symbiosis of aerobic Gram-negative rods in combination with a multiplicity of different enteric anaerobes. Streptococcal gangrene develops rapidly with massive oedema and erythema that progresses to skin vesicle formation and gangrene. Classification of a given infection into any of the above categories requires time for culture processing, and therefore may not be possible within the first few days of hospitalization. Moreover, because of the confines of limited microbiological facilities in developing countries, cultures of hand infections may not be practical at all in such locations.

Table 2. Risk factors for Tropical Diabetic Hand syndrome

1. Poor diabetic control and/or compliance
2. Low socio-economic status
3. Hand trauma (often trivial)
4. Delay in treatment
5. Female sex
6. Local herbal remedies?
7. Ambient humidity?

Various studies have shown that culture of tissue biopsy specimens reveal a single bacterial species in the majority of cases, whereas swab cultures tend to mainly yield polymicrobial flora, probably because of contamination.[26] Thus, routine swabs of open infected hands, in addition to not guiding optimal antimicrobial therapy, may not be cost-effective in hospitals with limited financial resources or laboratory facilities.

Stromberg[27] demonstrated that in patients who receive antimicrobials for persistent or recurrent hand infections, there was a tendency for hand cultures to yield relatively more mixed Gram-positive or Gram-negative organisms, and less Gram-positives. Also, he found a relative increase in anaerobic, fungal, and Gram-negative infections in patients who were previously treated. This may be due to a selection process secondary to antimicrobial usage in the initial infection which covered just the Gram-positive organisms.

In a study of 200 consecutive cases of hand infections, Stern and colleagues[16] found that 77 % of patients who developed complications grew organisms that were sensitive to the antimicrobial with which they were being treated, suggesting that other modes of therapy, such as surgery, may be equally or more important for a favourable outcome. Notably, they demonstrated that the empirical selection of a broad-spectrum antimicrobial agent for treatment of hand infections is reasonable based on *in vitro* susceptibility testing. Therefore, in view of the complications associated with mixed infections and anaerobes, and the favourable outcome of treated Gram-positive infections, antimicrobial coverage should be broad spectrum to cover Gram-positive, Gram-negative and anaerobic pathogens.

## Outcome and Management

In terms of outcome, TDH syndrome has serious implications. Of Akintewe and colleagues original 5 cases,[8] 4 had finger amputations (80 %), and the fifth patient took their own discharge. In the series of 60 cases reported by Bosseri and Gill,[13] there was an 11 % amputation rate, again mostly of digits. This was, however, a retrospective 'status of survivors' study. It is possible that high upper limb amputees may have a limited life expectancy, causing this Libyan series to have slightly favourable selection bias. The report of 20 American cases by Mann and Peacock[19] included 7 (35 %) amputations, with one below-elbow, and one mid-forearm procedure. As well as the obvious endpoint of amputation, many who escape this treatment are left with functional disability, and prolonged hospitalization is often needed (in one report a mean of 31 (range 6–75) days).[13] There is no detailed available information on mortality, though it is striking that all of the 4 Tanzanian patients reported by Archibald *et al.*[14] died, and one of the 2 reported by Gill *et al.*[6] probably died after discharge. Even survivors who escape major amputation frequently have serious loss of function,



 

Table 3. Management strategies for the Tropical Diabetic Hand syndrome

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| 1. | Hospitalization and hand elevation |
| 2. | Multiple intravenous antibiotics[a] |
| 3. | Optimal glycaemic control[b] |
| 4. | Adequate and early surgical drainage |
| 5. | Prompt amputation if necessary |
| 6. | Vigorous rehabilitation |

[a]Antibiotics should cover staphylococci, Gram-negative organisms, and preferably also anaerobes.
[b]Use insulin if necessary.

which may be catastrophic for the wage-earner of the family. In addition, lengthy periods off work are needed during hospitalization, recovery, and rehabilitation.

There are no accurate data or trial evidence on optimal treatment but most authors recommend hospitalization and hand elevation, aggressive intravenous antibiotics, and early and adequate surgical drainage of pulp-space or palmer-space infection (leaving the wound open to drain).[8,18] Suggested treatment strategies are outlined in Table 3.

## Conclusions

The very stereotyped clinical picture of hand sepsis among diabetic patients in the tropics has been previously poorly described. It can be thought of as a syndrome complex, and in the past has been termed the 'Diabetic Hand'.[8] This however may be confused with finger limited joint mobility (LJM), or 'cheiroarthropathy', hence our suggestion of the term 'Tropical Diabetic Hand.'[6] The syndrome has been reported from western countries, but reports similar to current cases in the tropics are now old, and involve poorly controlled and compliant patients of low socio-economic status. TDH syndrome seems to be now essentially confined to the tropics.

Diabetic hand sepsis in the tropics deserves further investigation, in particular with regard to its aetiology, epidemiology, and treatment. A number of questions arise. Why do women seem to be at particular risk? Is the apparent clustering in coastal areas genuine, and if so why? We hope that this descriptive article may stimulate tropical doctors to report and investigate this syndrome in the future and draw the attention of Western colleagues to its potential to afflict people with diabetes.

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